

大氣模式輸入場解析度對風暴潮模擬準確度之影響

The effect of input resolution for atmospheric models on storm surge simulation

吳祚任¹ (Wu T.-R.) 葉宸豪¹ (Yeh C.-H.) 張哲瀚¹ (Chang C.-H.) 林君蔚¹ (Lin C.-W.)

¹國立中央大學
¹National Central University

摘要

颱風引發之風暴潮長期以來對台灣沿海地區構成重大威脅，因此發展準確且即時之風暴潮預報系統極為重要。目前中央氣象署採用TWRF大氣模式產出的氣象場進行風暴潮預報，其水平解析度為15公里。然而，台灣地形極為複雜，尤其中央山脈對颱風結構與強度有顯著影響，而此類效應在現有解析度下難以充分展現。

本研究旨在透過整合氣象署區域決定性天氣預報系統（WRF_D）之高解析度氣象資料，將輸入格點解析度提升至3公里，以增加風暴潮預報的準確性。研究之關鍵在於計算成本與預報精度間之平衡。

本研究以康芮颱風為例，分別以原始與高解析度氣象場進行風暴潮模擬，比較其對颱風結構與沿岸水位預測的影響。同時評估高解析模擬所需的運算資源，並量化預報改善幅度。研究成果可為台灣地區之地形複雜區域提供風暴潮預報系統優化之科學依據。

關鍵字：COMCOT風暴潮預報、TWRF大氣模式、模式解析度、WRF_D

Abstract

Typhoon-induced storm surges have long posed a serious threat to coastal regions in Taiwan, highlighting the need for accurate and timely forecasts to support disaster mitigation and early warning systems. Currently, the Central Weather Administration (CWA) operationally produces storm surge forecasts using meteorological fields from the TWRF atmospheric model with a horizontal resolution of 15 kilometers. However, Taiwan's highly complex terrain—especially the presence of the Central Mountain Range—significantly influences typhoon structure and intensity, and such effects are not adequately resolved at the existing model resolution.

This study aims to improve the accuracy of storm surge forecasts by integrating high-resolution meteorological data from the CWA's Regional Deterministic Weather Forecasting System (WRF_D), increasing the input grid resolution to 3 kilometers. A key focus of this research is to strike a balance between computational cost and forecast accuracy.

Using Typhoon Kong-Rey as a case study, we compare storm surge simulations forced by both the original and high-resolution atmospheric fields, evaluating differences in predicted typhoon structure and coastal water levels. Additionally, we assess the computational expense of high-resolution simulations and quantify the forecast improvements. The results provide a scientific basis for optimizing storm surge forecasting systems in regions characterized by complex topography, such as Taiwan.

Key words : COMCOT-Storm Surge Forecasts, TWRF Atmospheric Model, Model Resolution, WRF_D